# Upcycling through crafts

uncovering methods for craft-based upcycling design

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## Abstract

Despite the fact that upcycling has won interest from designers, researchers, businesses and DIY hobbyists, it is still an emerging process and there is not enough research done in the academic and practical fields. Essentially upcycling is the upscaling, upgrading version of recycling, in a world where there are simply too many things. Previous design research has been conducted based on fashion and textile upcycling, however very little research related to upcycling of other material is being conducted. Especially when confronting a foreign material, for example waste plastic, there are simply not sufficient guidelines or methods offering possible design solutions. The objective of my research is to develop methods for craft-based upcycling design via a literature review, interviews and a practice-led research on the waste plastic material. The literature review is aimed at understanding what our current knowledge of upcycling turns out to be: our definition of upcycling, the benefits and results of upcycling as well as mapping out the challenges and support encountered. Interviews with two upcycling designers and two educators in Finland form the case study and the inspiration for this study. My own material exploration through practice-led research illustrates possible methods related to craft-based upcycling design.



Keywords: upcycling, crafts, DIY, practice-led research, sustainable design

# Introduction

## Context

Research related to plastic upcycling in the design and crafts field is not adequate and there are gaps in the current state of knowledge, as Sung (2015, p. 29) has described: “Besides fashion and textiles, and plastic recycling, academic publications have not paid sufficient attention to public concerns such as the upcycling of crafts, hobbies, and domestic DIY for household utensils, furniture, jewelry and other accessories”. She also pointed out in spite of the emphasis on consumer involvement in design regarding creating product attachment, previous studies have not yet paid sufficient attention to everyday activities, especially upcycling at the domestic level.

Our human society has been rapidly developed over the past decades: involving population, economics, production of plastics, consumerism and our throw-away lifestyle, which has affected our environment more strongly than ever before: If there is no resolution and our awareness is not enhanced, there will be more and more plastic trash introduced into our eco system which will ultimately ruin our precious planet.

Plastics have brought massive economic benefits to our human society, thanks to their combination of low cost, versatility, durability and high strength-to-weight ratio. The success of plastics is reflected in the exponential growth in their production over the past half-century. According to the Plastic Europe’s report (Fig. 1), since 1964 plastic production has increased 20 times, reaching 311 million tonnes in 2014. Plastic products are expected to double again in 20 years and almost quadruple by 2050. However, among all these plastics we created, only 2% were effectively recycled (Fig. 2), the rest of it ended up in the ocean and landfills, where animals eat them by mistake because they consider it food. There is even a term called ‘plastic diet’ that refers to human consumption of those plastic eating animals, for all it is very harmful for health since plastic is poisonous.

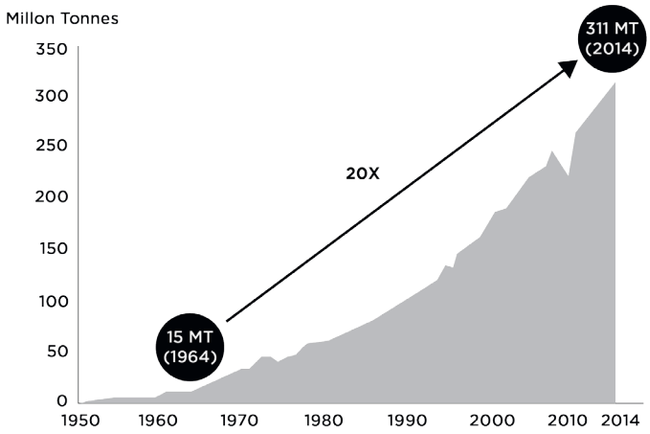


Fig. 1: Growth in global plastics production 1950-2014.
Source: PlasticsEurope, Plastics – the Facts 2013 and 2015

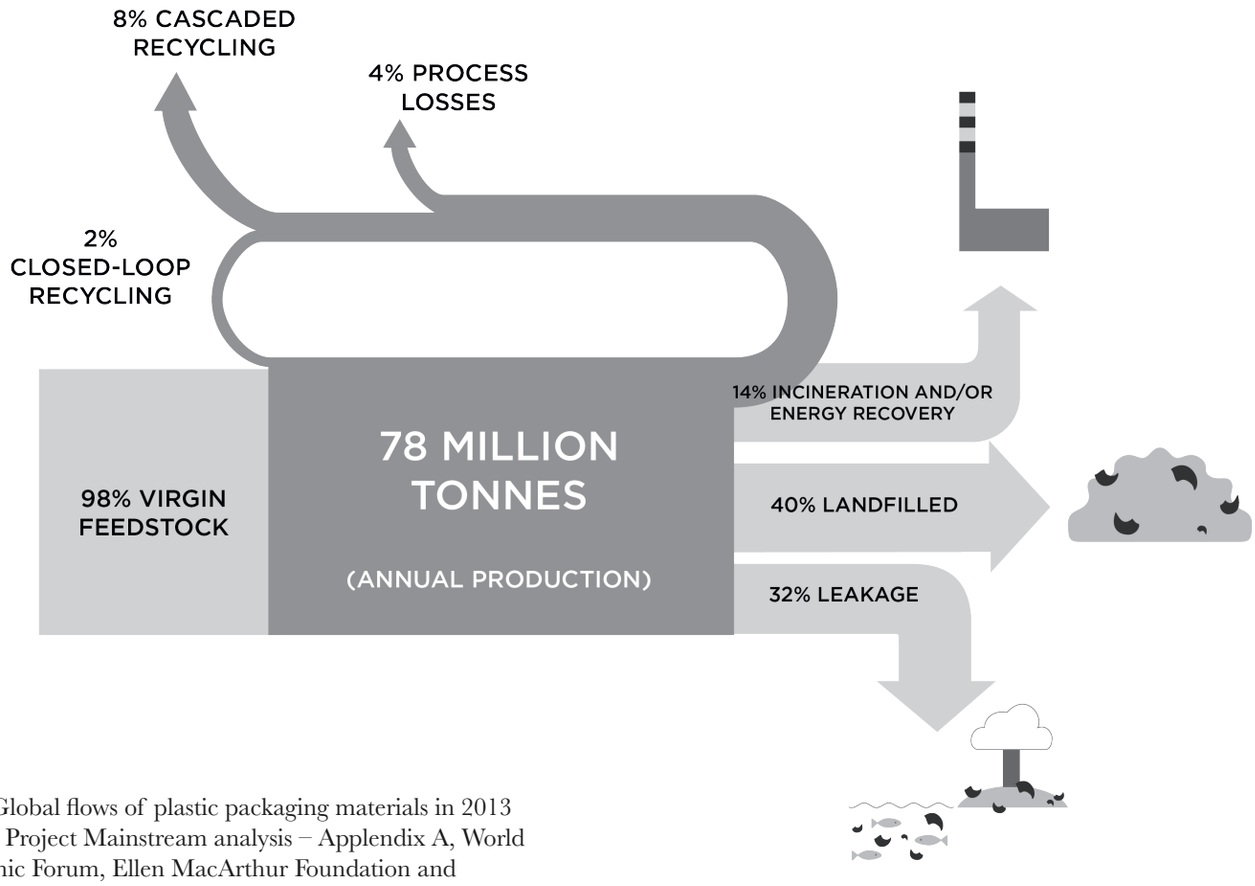


Fig. 2: Global flows of plastic packaging materials in 2013
Source: Project Mainstream analysis – Applendix A, World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company.

The good thing is, individuals and businesses have already taken action by offering alternative ways of doing business. For example in Finland, Globe Hope creates bags and clothes from military fabric; Toinen Elämä creates jewelry and accessories from rubber tiles; Mifuko organizes a group of African women to weave beautiful baskets using industrial plastic, which offers those women chances to earn income and escape from poverty; Trash Design gives old furniture parts new form, function and new life; Plan B creates bags and clothes from textile waste; Designer Willem Heeffer even turns old washing machine drums into lamps. At the Finnish household level, people are trained in different crafts skills such as sewing, crocheting, knitting or woodworking. Typical DIY projects they prepared are: baskets using coffee packaging, rugs woven from old fabrics, crocheting work from T-shirt yarn, pouches made from candy wrappers.

Although the idea of upcycling via craft is great, because of challenges such as unstable material source or the work being time-consuming, they are still only emerging businesses or individual actions, which haven't been adapted to our mainstream culture on a larger scale.

# Motivation

My Bachelor degree is in Industrial Design in China and throughout the study I realized my interest lies in crafts instead of mass-produced products. My bachelor's final thesis work concerned craft-based upcycling, which offers solutions for combining waste materials (Fig. 3 and 4) with ceramics. I entered Aalto University's Applied Art and Design Department (currently Product and Spatial Design) for my Master's study. The school has a wide choice of workshops to choose from which is ideal for me to develop a broader knowledge and practice of craft making processes.

In 2016 I was traveling by train across India and two children were sitting next to me drinking bottled water. I was shocked to find after they finished drinking, they followed their father's instruction to throw the empty plastic bottles out of the train's window! How can a father advise their children in such a way? I pondered about this question for a long time until I told my friend who has been living in India for six years about this experience, he laughed and told me it is because people do not understand plastic material, what it is, and how harmful it is when you consign it into the environment. Previously, all containers and packages in India were made from organic materials such as leaves or bamboo sticks. It is ok to throw them directly on the ground and they will be disposed of easily. However, when people started utilizing plastic packages, they treated them in the same way as the organic materials. Simply because they have no idea how difficult it is for plastic to dissolve; it will exist almost forever. This experience led me to realize that it is important to raise people's awareness about the environmental problems that plastic brings.

I often visit our local recycling center (kierrätyskeskus), where all kinds of second-hand products are sold at fair prices. Once the recycling center organized a public open day for people to see their sorting system and their warehouse. I was shocked to see several piles or "mountains" of waste people have donated. I started to ask myself: what is wrong with our society? Then I started to recall something that someone pointed out to me before: "We need to provide enough jobs for our population, we have to

Fig. 3 and 4: My Bachelor's final work was tableware and jewelry combined with wasted yarn, 2011.
Photos: Wang Jing

create, to purchase, to throw away again, and to create, to purchase and to throw away again...to guarantee there is enough jobs for everyone, that's how our economy functions." I do not want to be judgemental, but as a creator myself, what should I do? Why not use existing materials for my creations? Since there are huge amounts of waste created every day, if we do not take any action, it will eventually end up in landfills or in the ocean and threaten the environment and eventually, us too.

As an action towards dealing with this problem, I started to make jewelry from plastic bottles. The jewelry I made were good enough to be sold in different design shops in Helsinki and attracted attention from many people. Then I started reusing yarn from old sweaters, washing and dying yarn into different colors and designed these knitting patterns that were knitted into new clothes (Fig. 5).

Fig. 5: Peacock coat made from recycled yarn, modelled and designed by me, knitted by Maire Heikkinen, 2017.
Photo: Tiina Eronen

*"One may approach sustainable practice with a focus on materials, by building communities, by changing the way users interact with products and services, or by focusing on using, reusing, recycling. However, it is not limited to these examples. Sustainability can mean so many different things, it challenges practitioners to be visionary, adaptable and innovative"*

*- Sharon 2013, p. 13*

In addition to my own background of design and interest in crafts, I decided to achieve sustainable design by upcycling through craftwork, at the same time raising people's awareness of the harmful effects being caused by disposable plastic materials in our throw-away culture.

## Objectives

Upcycling has stimulated enormous interest among designers, hobbyists and small businesses, however, it is still an emerging phenomenon: not all of them are bringing about upcycling. Shortcomings include inadequate background education or related skills (art, design or handicrafts), lack of suitable tools or machinery, unsuccessful choice of products to create, and, especially a lack of specific guidelines or methods for designers to follow. My goal in this research is to develop methods for conducting craft-based upcycling design.

## Research question

My research question is: What methods could be developed for craft-based upcycling design?

# Research Methods

There are three parts of the research: literature review, interviews and practice-led research. (Fig. 6)

**1. Literature review**

First of all, a literature review was conducted demonstrating a general knowledge of upcycling and practice-led research in the academic field. The scope of the literature review includes: understanding the definition of upcycling, the benefits of upcycling, the results of upcycling, the challenges, restrictions and support for upcycling and ways to scale-up upcycling businesses etc. Books, articles, online resources were reviewed and analysed. Thus, the research questions for my literature review were: What is upcycling? What are benefits of upcycling? What are the results of upcycling? What are its challenges and support? What is practice-led research and how can I conduct such research?

**2. Interviews**

"Interviews do yield a great deal of useful information. According to David Silverman, facts, people's beliefs, feelings, motives, behavior both present and past, the conscious reasons for action or feeling, can all be probed in the interview format" (Silverman, 1993 in Na, 2013, p. 29). The aim of the interviews I conducted was to investigate professional upcycling designers and educators in Finland, to get to know their approach to upcycling design, to discover what kind of materials and techniques they use, what kind of products they make and how they see or judge their upcycled products. The research brought some real-life examples of current craft-based upcycling design situations, which also provided inspiration to my own design. Research questions for the interviews were: what materials do they use? Where do they get the materials? Where is their inspiration coming from? What techniques do they use and what products did they develop? And how do they see their own design? What are the key factors contributing to successful upcycling design?

**3. My own practice-led research**

As Mäkelä describes (2007, p. 160) by refering to other writers "all creative practice that meets precise criteria can be regarded as research. The requirements are must be explicit research questions, specific methods for answering the questions and a specific context in which the research has been carried out" (AHRB 2001, p. 7; Biggs 2002, p. 19; Scrivener 2002, p. 33). Along with the question of finding out feasible methods for upcycling design, this practice-led research is considered the most important part of the whole enterprise.

During my master's study, I had the chance to explore all kinds of craft techniques: sewing, weaving, crocheting, fabric dying, spinning, woodworking, ceramic making. In my practice-led research such practices were adapted to plastic materials. Various types of data was collected during the processes: diagrams, sketches, notes, photos and videos. Along with this data, I set up criteria in advance and evaluated the results accordingly, and thus find out related creative methods.

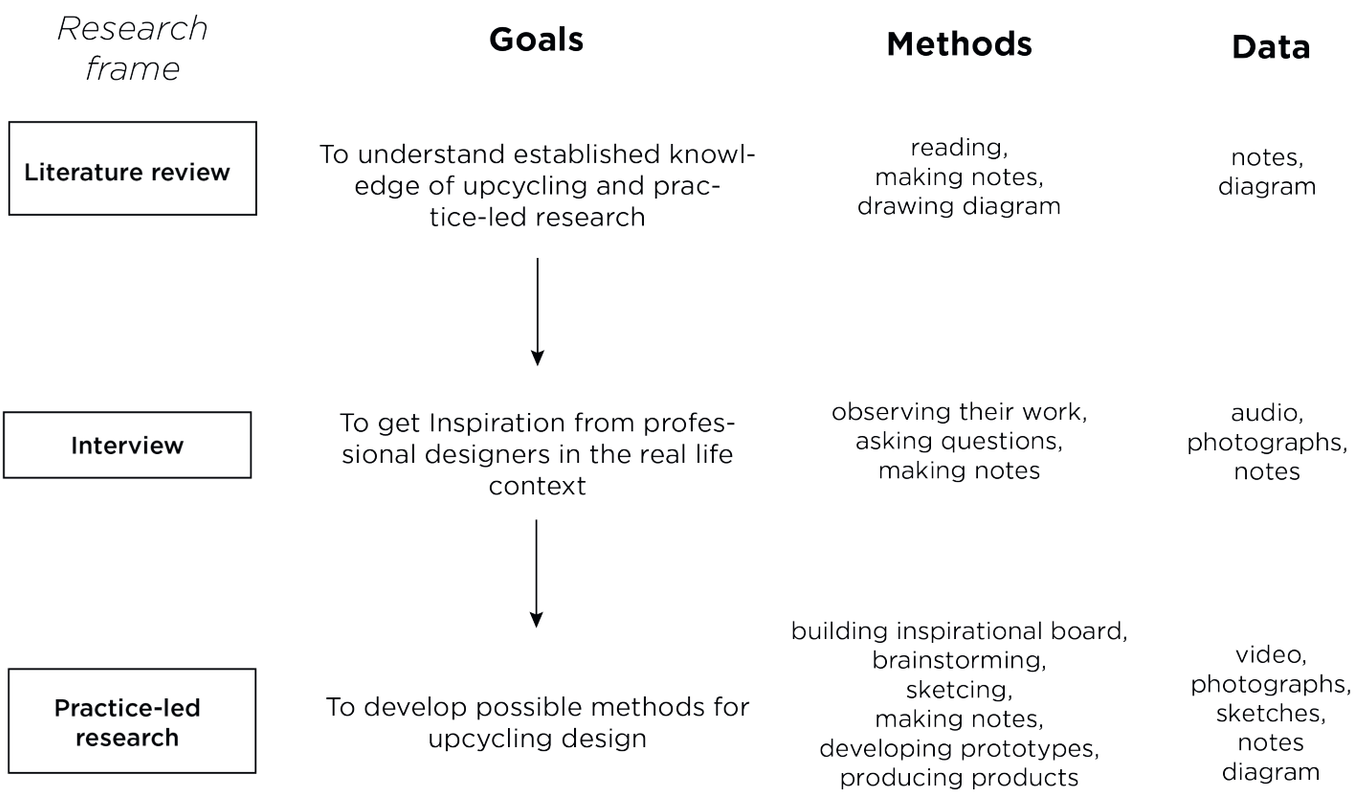


Fig. 6: Diagram of research methods, goals, and what kind of data to collect, image by Wang Jing

# Literature review

## Definition of upcycling

"Upcycling is a process in which used materials are converted into something of higher value and/or quality in their second life. It has been increasingly recognized as a promising means to reduce material and energy use" (Sung, 2015, p. 28). "It is an umbrella concept which incorporates 'creative' repair (e.g. darning), reuse (e.g. redesigned and remade clothing), refurbishment (e.g. upholstery), upgrade (e.g. IKEA furniture hacks), recreation (e.g. fashion items from clothing) and more" (Sung, Cooper, Ramanathan & Singh, 2017, p. 397). In Sung's article (2015) A Review on Upcycling: Current Body of Literature, Knowledge Gaps and Way Forward, she pointed out that the concept of upcycling has gained more attention from various business practitioners, researchers, and craft professionals plus hobbyists in recent years. The majority of the research is in engineering and technology, in design and business fields, followed by research areas such as waste management, science, literature and lifestyle (Fig. 7).

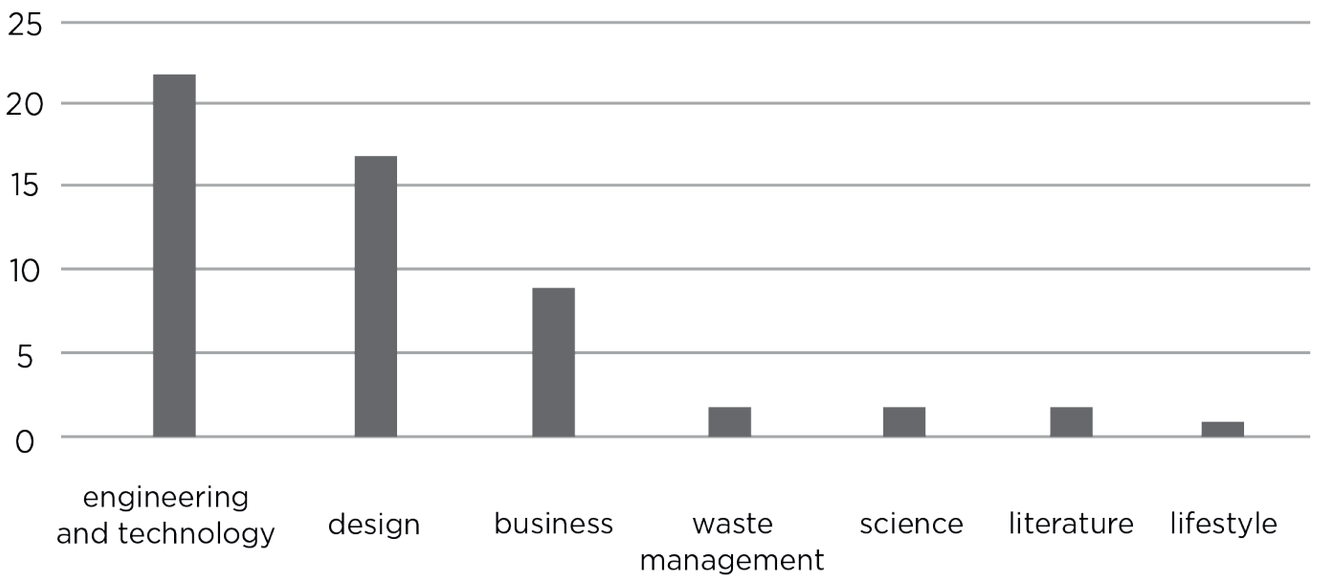


Fig. 7: Subject areas of sample publications
Source: Sung, (2015). A Review on Upcycling: Current Body of Literature, Knowledge Gaps and Way Forward (p. 3)

Fashion and textiles seem to be the most focused research area due to the huge pollution being created, followed by plastic upcycling and construction and organic waste treatment (Fig. 8).

Even though the upcycling is a neologism, it has existed for thousands of years as the individual practice of converting waste or used objects into objects of a higher value. Szaky (2014) explains that reusing and upcycling were common practices all around the world before the Industrial Revolution and are now more common in developing countries due to limited resources. Recently developing countries have paid more attention to object/product upcycling in a commercial perspective due to the current marketability and reduced cost of reused materials (Ibid., p. 767).

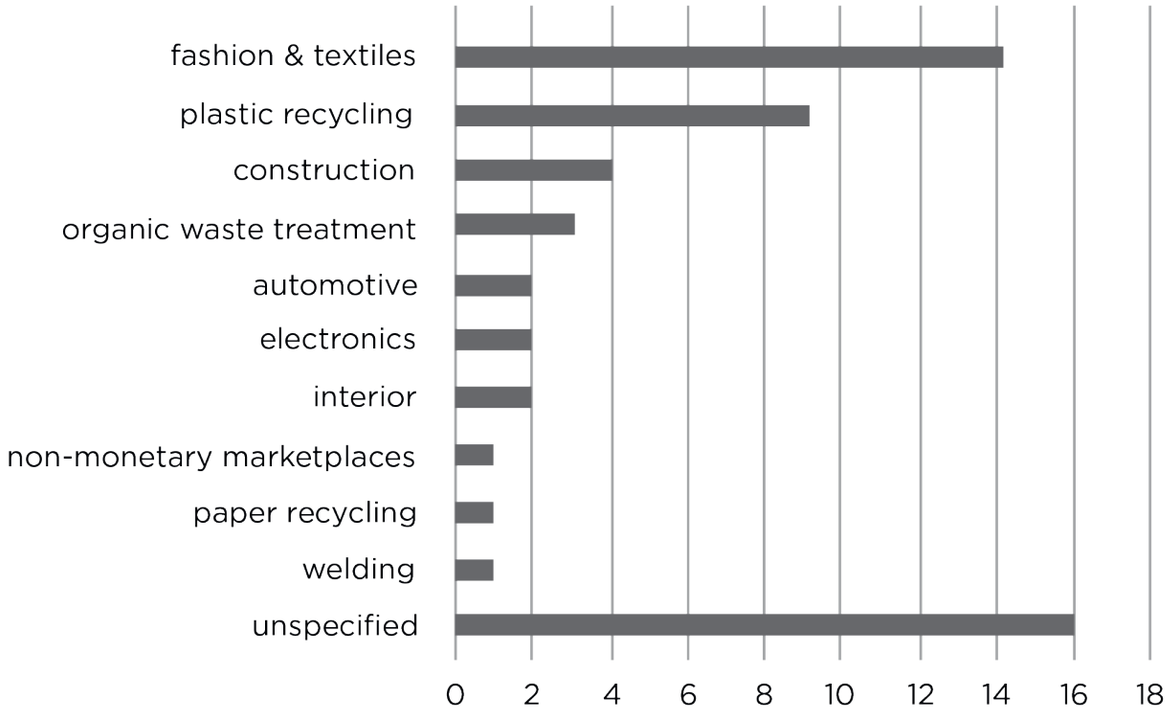


Fig. 8: Sampled publications distribution according to industrial (sub)/sector
Source: Sung, (2015). A Review on Upcycling: Current Body of Literature, Knowledge Gaps and Way Forward (p. 3).

## Outsmart waste

Szaky (2014) sees object upcycling as one of the most sustainable circular solutions since upcycling typically requires little energy input and can eliminate the need for new products from virgin materials. Compared to industrial upcycling, upcycling at home proves even more environmentally friendly because it avoids the environmental impact and cost that comes with transporting waste to the upcycling company and then transporting the upcycled products back to you.

Szaky (2014) introduced a process called outsmart waste, which is a process to transform the wasted we cannot avoid creating from useless trash to a useful resource, he also evaluated the role of upcycling as among all other outsmarting waste methods (Fig. 9). There is the scope ranging from the most sustainable way which is to stop buying; the least sustainable way which is consignment to landfill. Upcycling, alone with reuse and recycling, is one of the circular solution processes which connects to managing all the garbage we've created.

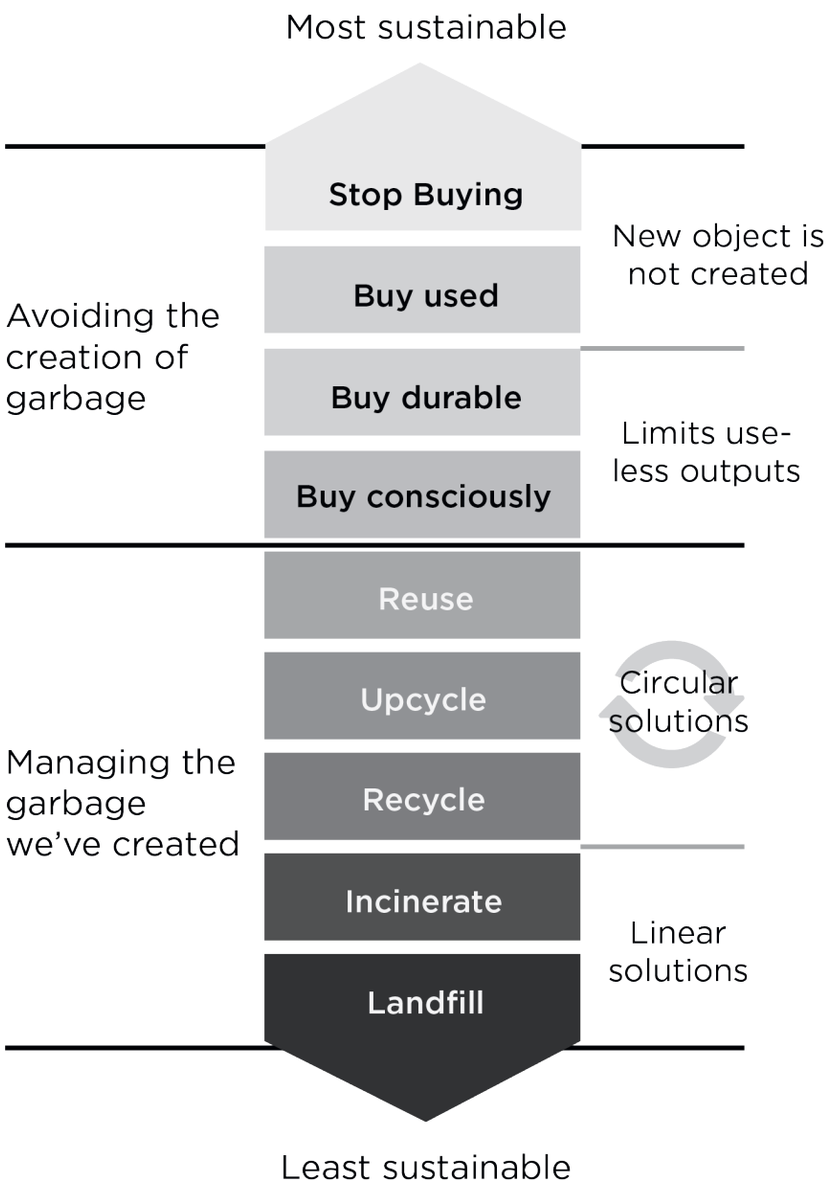


Fig. 9: Ways of outsmart waste.
Source: Szaky, T. (2014, p. 1115)

## Benefits of upcycling in general

There are naturally several benefits to achieve by upcycling. Sung (2015, p. 31) mentions several reasons for this in the following:

*"Product (re)creation by upcycling eliminates the need for a new product, therefore reducing new raw materials use and conserving the natural resources, as well as reducing energy usage, all of which leads to greenhouse gas emission reduction. When upcycling is done locally, it can be even more environmentally friendly than industrialized upcycling, by avoiding any transportation of the product line. Likewise, upcycling as an upgraded recycling on a small scale and decentralized process might save more embodied energy than if it were centralize"*

*- Sung, 2015, p. 31*

The process of MUC (Making, Upcycling and Crafting) may be rewarding because something pleasing and useful is happening and hand-crafted things carry the authentic and personal touch of the creator, making the creation special (Gauntlett, 2011). End products are for both practical use and creative self-expression (Frank, 2012; Gauntlett, 2011; Parker, 2012). Some authors see MUC as a journey or adventure on which process is often more valuable and meaningful than in any outcome. (Frank, 2012; Lang, 2012; Gauntlett, 2011). The journey is through self-discipline, discovery, failure, doubt, experimentation, exposure, change and the unknown is the real reward. (Frank, 2013)

Sung (2014, p. 4-6) described the benefits of individual craft-based upcycling, as Fig. 10 shown below:

| | |
|---|---|
| **Environment benefits** | The saving of the landfill space and the cost of recovering environment. |
| **Economical benefits** | To provide opportunities for new business; and saving the cost for processing raw materials |
| **Social benefits** | Environmental and social sustainability concerns; allowing DIY spirit and art therapy: craft making having its own healing effect. |
| **Creative benefits** | The production of something pleasing, useful, authentic and personal; Creative self-expression leaving its mark on the world; Simply being creative; Being good for concentration. |
| **Emotional benefits** | Generating inherent pleasure: "it is a sense of being alive in the process of being participants, instead of being mere viewers and relying on outside simulations. A sense of accomplishment; Generating happiness from goal-oriented activities and autonomy. |
| **Further benefits** | Belonging to a team/community, a way to burn up stress and to relax, by promoting clutter clear-out. |

Fig. 10: Benefits of craft-based upcycling
Source: Sung (2014, p.4-6)

## Results of Upcycling

Sung (2015, p. 3) also detects many issues that she calls “results” of upcycling use domestic craft methods, these are listed as follows: (1). Producing something useful and more valuable; (2). Making objects safe to recycle and organic materials safe to use; (3). Upgraded quality/value in the final product; (4). A better incarnation of objects or raw material with new life; (5). Allowing products multiple life cycles through remanufacturing or via 10% recyclability; (6). Economically and environmentally improved performance material

Though there are clear benefits to upcycling, it is still a marginal act because of its limited such as Shaky (2014, p. 860) mentioned there are three aspects which is restricting the expansion of upcycling business: (1). Not only is upcycling limited by the number of people who are willing to do it, yet the current market size is very small; (2). It is a relatively low volume solution compared to the total volume of waste; (3). Not everything can actually be upcycled

.

## Challenges and support for individual upcycling businesses

Through conducting a workshop with 12 upcycling enterprises in the UK, Sung, Copper, Ramanathan & Singh (2017) demonstrated five different aspects of challenges those enterprises face and correspondent support for them (Fig. 11). Challenges and support include five parts: materials, working environment, craft making, marketing and consumer awareness all shown below.

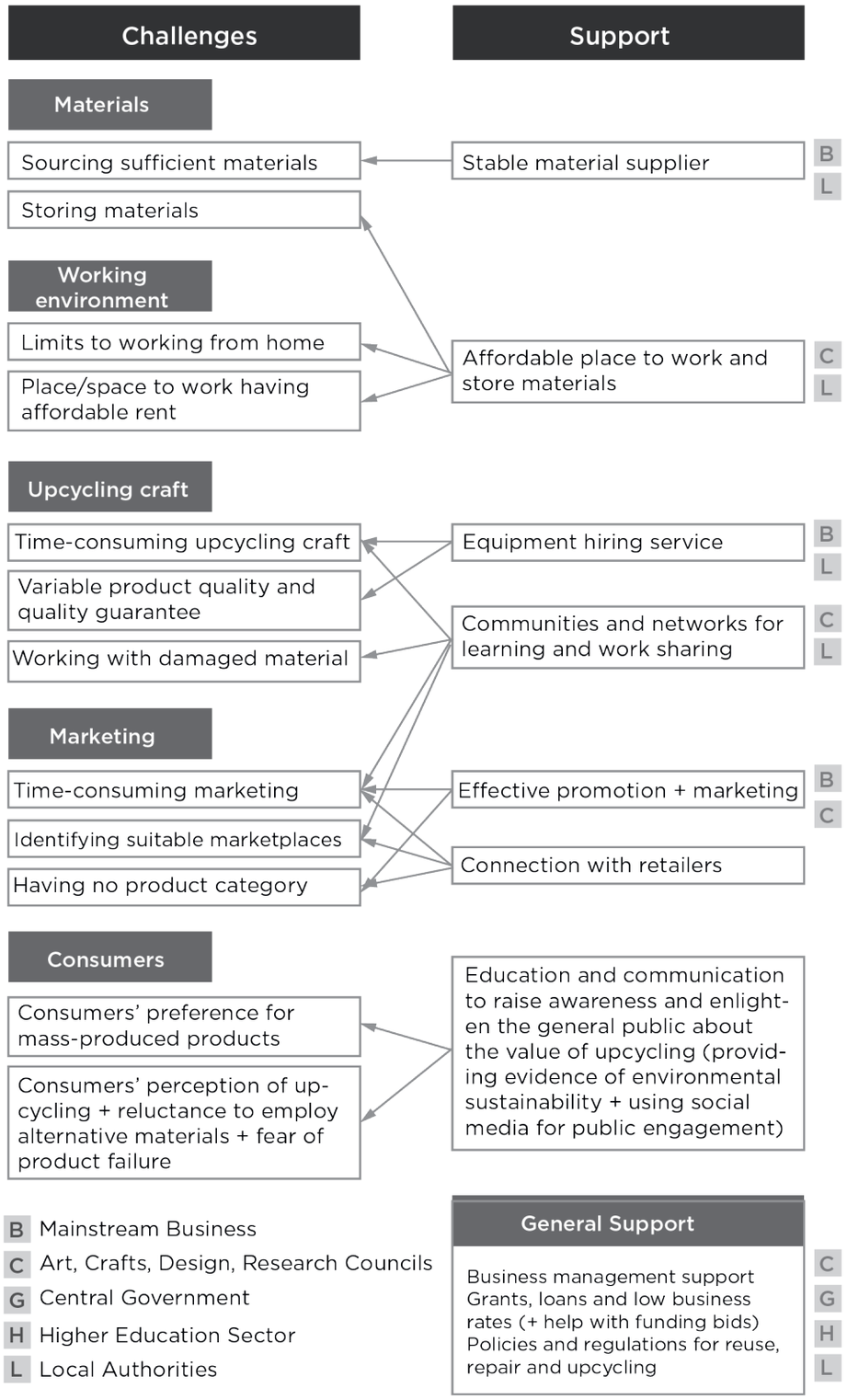


Fig. 11: Mapping out challenges and support for scaling up upcycling businesses with potential actors. Source: Sung, Cooper, Ramanathan & Singh. (2017, p. 400).

# Interviews

I interviewed two talented upcycling designers and two active upcycling crafts educators in Helsinki, Finland. I visited their home studios because this offers me opportunities to see what kind of materials, tools and machines used and what kind of products they create. Then I conducted one-hour interviews with each of them using basic questions such as “Where is your material from?”, ”What kinds of products do you create?”, plus using very specific semi-structured questions, unambiguously, leaving each of them have their own focus. I have to ask related questions to have a more specific knowledge of their thinking. I collected data such as photos, audios and notes, and analysis from data by sorting out the notes I made, creating diagrams and comparing each of their roles during the upcycling process, and evaluating what advantages they might have.

**Isa Kukkapuro-Enbom**
**Upcycling designer**

Dodo is a Helsinki based company specializing in trash design and interior concept planning, exhibitions, workshops and publications involving sustainable design and art. Dodo also promotes concepts such as Trash Design, Trash Factory, Trash Art, Trash Garden, Trash Cuisine, Rubbish Design, Brands old and Contemporary Design Platform (CDP). Isa kukkapuro-Enbom and her partner Henrik Enbom co-founded Dodo in 2011.

Isa was trained to be a fashion designer, however, when she realized there is a huge amount of waste created by the fast-fashion industry, she gave up her fashion designer career and instead, she became a trash designer. Isa’s partner Henrik is a well-trained carpenter and he has been working with Isa on different projects such as furniture upcycling (Fig. 12), interior decoration using waste material and specialised design for exhibition or art installation. Isa and Henrik recycle/upcycle almost everything you can imagine: from tomato cans (Fig. 13), old furniture, books, even construction materials.


Fig. 12 and 13: Upcycled stool and a lamp made from a tomato can crafted by Trash Design, Habitare 2017. Photos: Wang Jing

Isa believes it is a never-ending story collecting the human waste for her design. Contrary to old times, there is no notion of "design for a lifetime", almost everything now is mass-produced and expected to break down easily so that people can buy new things. It is also important to remember that we can also repair broken things, instead of just throwing them away. She suggested a formula as an inspiration:

**"Trash + Imagination = Possibilities"**

Isa also emphasized the importance of crafting the upcycled products properly, to achieve this does require a combination of good tools, learning related skills and long-time practices. The table they upcycled features fine finishing with a lot of help from good tools (for cutting and sanding), finest sandpaper and high-quality wax for good finish.

There is an installation work Dodo made for the Helsinki Habitare Design Fair, consisting of a wall full of chairs that people had thrown away. Isa purchased them for five euros each from a second-hand shop, and all of them are functioning well. What they want to achieve through this installation is to remind people of one question: Do they really need to purchase new things?

## Willem Heeffer
## Designer

Willem is a product designer who has been living in Finland for five years, he designs objects using industrial waste materials. He believes good design should be mindful of ecology and be ethical. Willem had built contacts with various local companies and factories, all guaranteeing that he has a stable material supply. Materials he employs for upcycling are tomato cans (Fig. 14), washing machine drums (Fig. 15), professional espresso machine boilers (Fig. 16) and ceramic parts of old phones. He turned them into all manners of lamps, by using sand-blasting and glazing techniques which he discovered and developed in a small factory in Helsinki. The lamp he produced is well-glazed and tagged with its original serial number, and each piece is unique.


Fig. 14, 15 and 16: Upcycled lamps made by Willem Heeffer.
Source: http://www.willemheeffer.nl/products/
(Courtsey of Williem Heeffer, photos by Yehia Eweis)

Willem did not consider his own design an eco solution even though he salvaged two hundred washing machine drums in all; there are still thousands of them being thrown away every day, so what he did was nothing under such circumstances. Also, in order to make his lamp, he needs to order high-quality accessories from suppliers from various countries, the purchase itself generates more trash and CO2 emission from shipping. Such high-quality accessories, combining with his fine finish of waste material forms his design. It is very hard for people to recognize his product are made from waste, which he considered is a prominent feature of a successful upcycling design.

Fig. 17 and 18: Upcycled products made from old jeans
Source: Annakaisa Kilpinen's website: http://www.tuunaajamutsi.fi/.
(courtsey of Annakaisa Kilpinen, photos: Annakaisa Kilpinen)

**Annakaisa Kilpinen**
**Workshop host**

Annakaisa presents craft-based upcycling workshops to individuals, companies and schools. In the interview Annakaisa told me, even though we are in a digital world, making things by hand is still vital for us because it encourages innovation and creativity, setting our brain off in new directions. Additionally, fashioning things together can enhance people's togetherness.

Materials she uses include old jeans (Fig. 17 and 18), leather, egg shells, yogurt packages, paper and whatever she finds at various companies and fairs. She stresses that the benefit of using wasted material is this: "You never need to worry about spoiling the materials, never need to worry about failure".

Annakaisa suggests that when doing upcycling, innovators should try to use every part of the material. For example, when she upcycles a pair of jeans, she tailors the most part for her sewing project, then converts its zipper and edges into jewelry, then cuts out the leather features for decorating bags, leaving the leftover fabric scraps then to save for accessories.

**Isabella Haas**
**Upcycling designer, workshop host**

Isabella has a Bachelor in Industrial Design, and she is always concerned about issues related to sustainable development in our society. She founded the Helsinki Upcycling Design Center, where she organizes immigrants to create products out of waste materials. Materials she uses are old fabric, rubber tyres (Fig. 19), safety belts, advertisement banners (Fig. 20) and computer parts. Material sources are museums, companies and fairs. Products they manufacture are purses, jewelry, accessories and bags. She also gives workshops aimed at raising people's awareness.

Isabella suggested designers should broaden their range of materials, to consider using waste material instead of raw material. It is crucial to know that waste materials do not necessarily mean low-quality materials. When designing a product, it ought to be designed to last. Most successful upcycled products are of high quality and it is not easy to see what material it has been made out of. They are almost the same as products made from virgin materials.

Fig. 19: Upcycled workshop with rubber tyres


Fig. 20: Purses made from advertisement banners
Source: Helsinki Upcycling Design Center's website: https://upcyclingdesigncenter.com/.
(courtsey of Isabella Haas, photos: Isabella Haas).

## Analysis of the interviews

During the data sorting process I started to realize there are three groups of people involved in upcycling craft work; all categorized by various focuses: Designers, Educators and DIY hobbyists. Designers are focusing on creating new products or solutions, teachers tend to focus on spreading the seeds of sustainable thinking to other individual or groups; hobbyists are developing a focus of their own interests (Fig. 21). However, no matter what your background and focus might be, it is essential to consider the below-mentioned factors before and during upcycling projects that enable you to do your own process successfully:

* Think out of the box. Unlike traditional design processes, upcycling design requires working from the materials' properties and state. Waste materials are not equal to low-quality materials; they are just not serving their intended functions anymore. Thus, we should think out of the box and really study the material itself; do not become too attached to its previous function. Observe its shape, texture, strength and figure out what type of craft techniques might be matched to this material.

* Experiences, related background skills and learning are required for upcycling design; skills such as sketching, painting, woodworking, crocheting, sewing, industrial design, fashion design. Previous knowledge of related skills can be the source of inspiration and key to creative solutions. Research on the related techniques also proves important, the Internet is one of the best sources of finding related information giving opportunities for learning new skills.

* Good tools, machines and accessories can enhance the quality of the products. Good tools or machines save time and effort, finding good quality accessories matching the waste material is also vital.

* Passion for design or craft making comes as Willem described: "It just happens to me." Because of his passion and curiosity in material exploration, it naturally led him in this direction. The design process of upcycling demands time to incubate new ideas, together with other iterations of development so that the products quality can reach a professional level. Sometimes when he gets a material, he will put on his thinking cap and brainstorm what to do with it for several months, sometimes even more than half a year. He is obsessed by exploring new techniques, which often takes hours of searching the Internet.

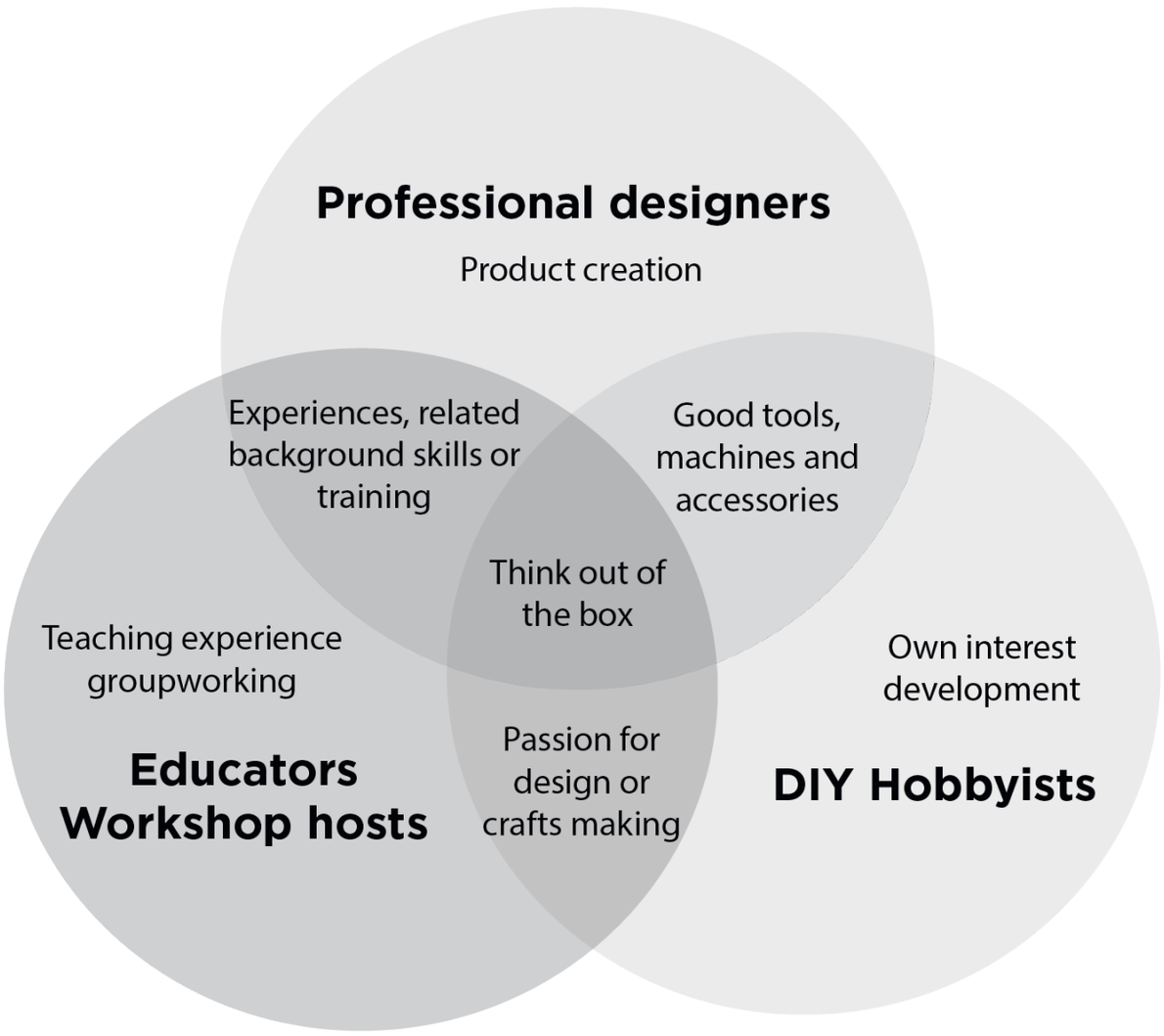


Fig. 21: Results of the interview, a designer's view on how to upcycle successfully. Image by Wang Jing.

# My own practice-led research

Thus, being inspired by the literature review and the interviews, I began my own practice-led exploration of the upcycling process. The practice-led research consists of: setting up design criteria, brainstorming, building up an inspirational board, experimental prototype, product producing and reflection on the process. The documentation of the whole process followed by collecting data such as sketches, notes, diagrams, photos and videos enabling me to have a deeper understanding and analysis of the methods I used.

However, before starting my own practical work, I set up several design criteria such as making the utmost use of waste materials, to avoid creating new trash; working with easy-to-get household tools and materials because I trust craft-based upcycling can be easily conducted by a wider range of people. Final products should be designed as beautiful, practical and durable objects suiting the results of upcycling as Sung (2015, p. 3) described, so there will be potential business possibilities to sell the work on the market, this might offer creators opportunites to earn income, especially those in developing countries or poor areas.

Starting from the research of the Ellen McArthur Foundation (Fig. 23), I had a brief understanding of what type of plastic materials are used in our life-style. Then, I followed a brainstorm session of what the trash I usually create in my daily life (Fig. 22) such as redundant plastic materials for upcycling such as plastic bottles, plastic bags, coffee cups and lids, food packages, plastic straws. These I compared it to the main plastic resin types detected by the Ellen MacArthur Foundation.


Fig. 22: A brainstorming of what kinds of plastic trash exist in our daily life. Image by Wang Jing.


Fig. 23: Main plastic resin types and their applications in packaging
Source: Project Mainstream analysis – World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company.

Despite the fact there a wide range of material to choose from, and due to a limitation of time to spend on this project, I had to narrow down my choice of materials and be more conscious of the design process itself, thus, I decided to use two common plastic materials: plastic bottles and plastic bags. Those are very common waste in China and still there is no good solution to how to deal with them after usage.

Thereafter I followed with the building of an inspirational board using internet resources (Fig. 24); the board provided me with visions of various craft projects people had created, combined with the use of craft techniques having the possibilities of utilizing plastic material. To begin with, I usually type keywords such as craft related techniques or materials on their search bar, for example, I typed keywords such as "crochet" or "plastic", plus related images that came up. These might be existing crochet projects such as bags, coasters, gloves, scarves, I collected images which caught my interest without overthinking or judging them. They might be because they were practical products, or presented as nice pattern designs with proper application of materials.

## Inspirational board

I named my inspirational board “upcycle” (Fig. 24); therein all kinds of upcycle projects were collected: jewelry from waste leather, doll houses made from shampoo bottles, plastic straw weaving, artwork made from waste wood; There were also designs which are not relevant to upcycling but once catching my eyes because they have elegant color combinations. In this case I collected all of them and decided to apply a comparable color code in my later crochet work. Such an inspirational board was a gathering of these ideas that not only kept insight for now, but also inspired me to onwards planning, using material exploration via prototype creation and product production.

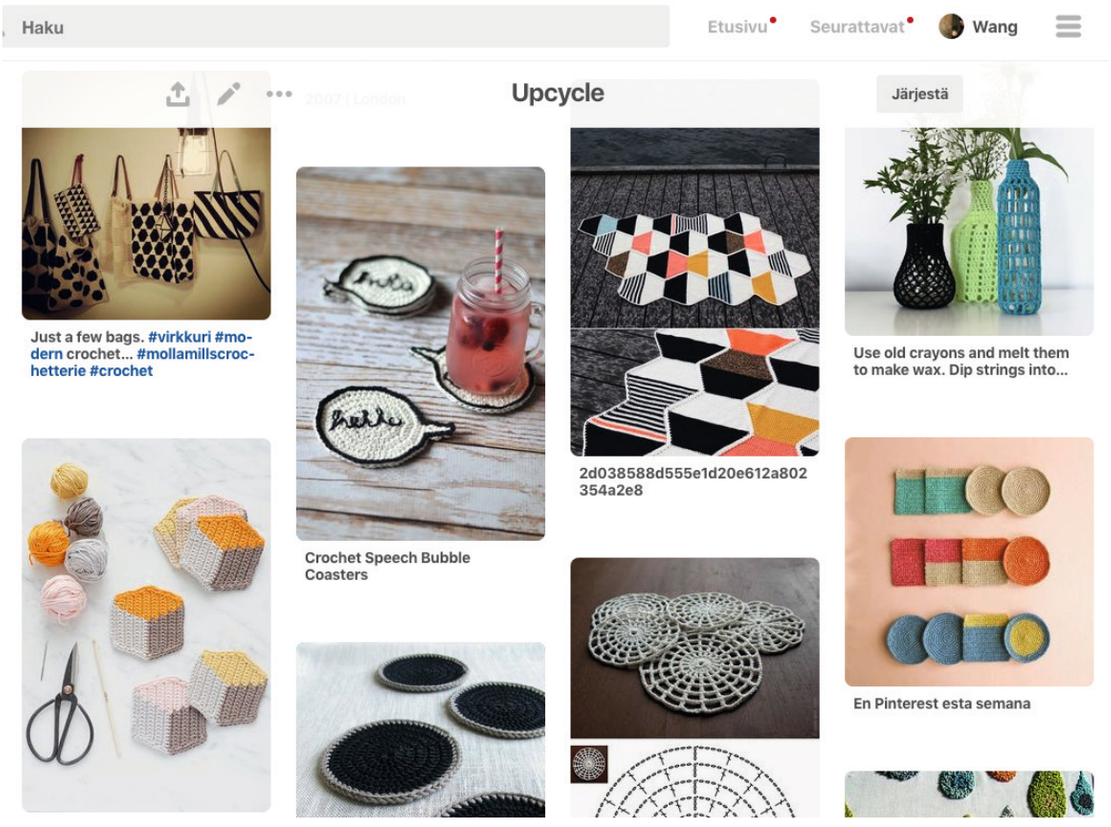


fig. 24: I gathered different images and built a digital inspirational board using the Pinterest board
Source: Wang Jing’s Pinterest board ‘upcycle’: https://fi.pinterest.com/wangjing/upcycle/

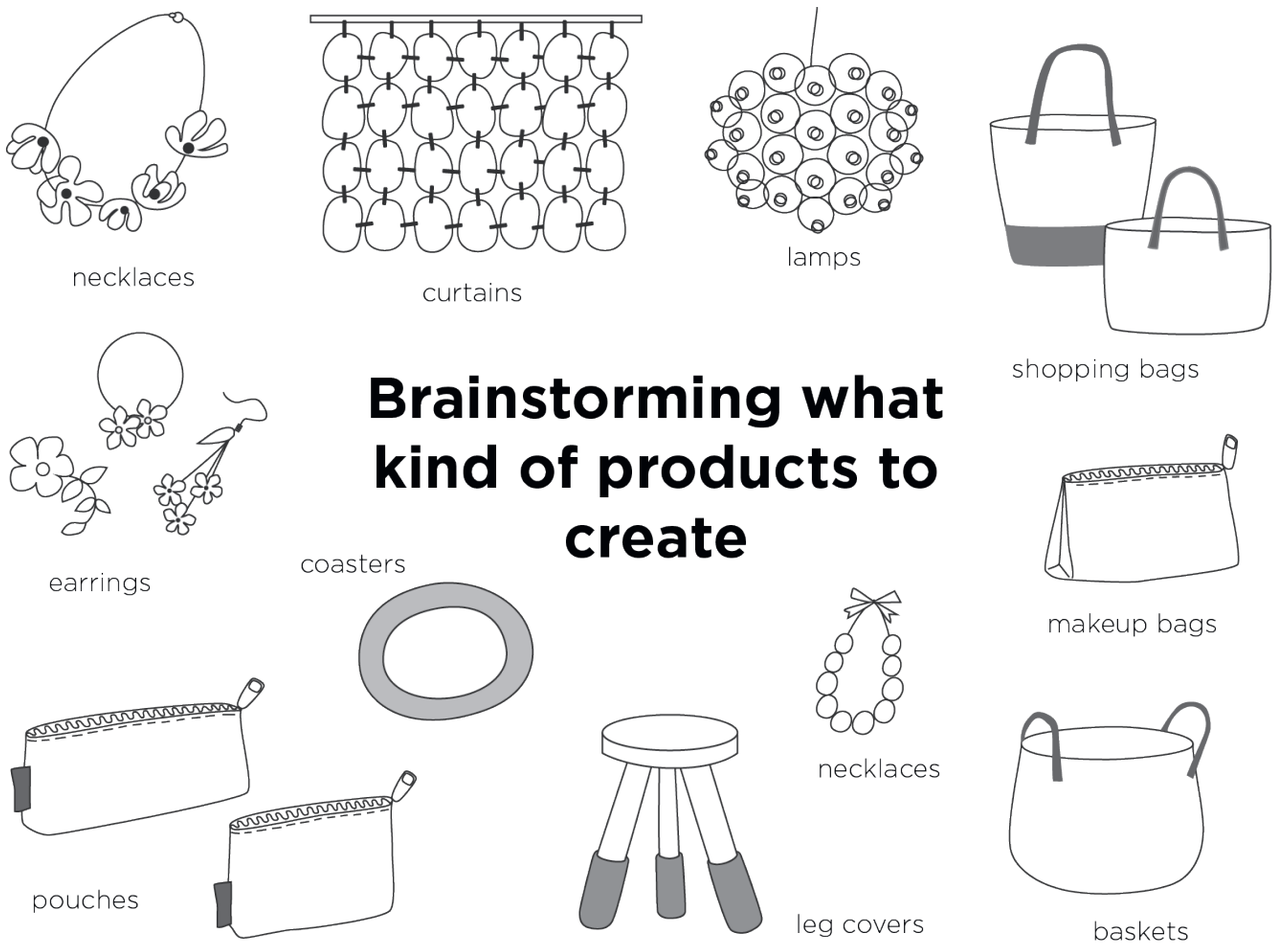


Fig 25: Results of a brainstorming of what products to make. Image by Wang Jing.

Now inspired by many different craft works, I launched another brainstorming session (Fig. 25) related to figuring out what kinds of products can be developed out of plastic material. According to the design criteria I had already set, I planned to create practical products such as bags, pouches, coasters, baskets and jewelry. I wanted to broaden their current function, to show people the potential use of plastic material, to expand its lifespan and, at the same time, demonstrate a higher value than their previous role. Such disposable products can be transformed into durable products.

After deciding what to make, I listed possible related craft techniques; I was interested in trying out plastic bottles and plastic bags (Fig. 26). There are three lines of technique: (1) For creating jewelry made from plastic bottles, I used a combination of cutting-drawing-trimming-melting-assembling techniques; (2) Then for plastic bag fabric work, by sorting-cutting-fusing-cutting-sewing techniques by using plastic fabric I created all kinds of sewing projects; (3) The last combination of techniques was for plastic yarn crochet, with which I decided to use sorting-cutting-crocheting techniques.

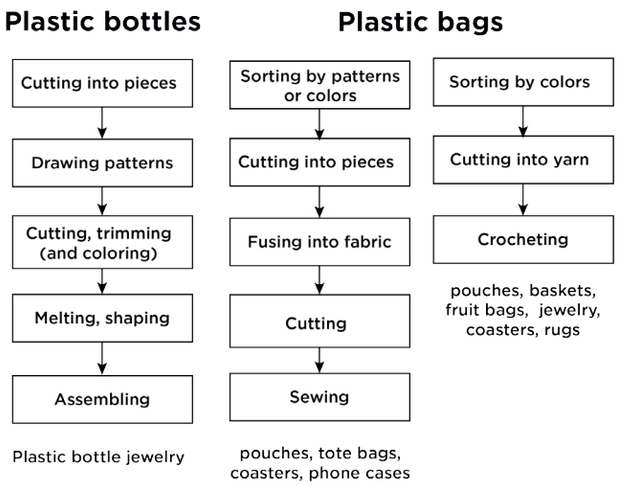


Fig. 26: Craft techniques I chose for my craft-based upcycling project. Image by Wang Jing.

## Concept and visualization

Inspired by Finnish crochet artist Molla Mills' minimalistic geometric patterns made with simple basic single and double crochet stitches (Fig. 27), I decided to develop similar pattern styles and applying them on my plastic crocheting projects. Traditionally the crochet pattern contains a combination of various colors and stitches, such as granny squares design. However, the pattern Molla created consists only a limited amount of colors and stitches, but with a lot of restating of the same pattern. I appreciated this minimalistic style because I believe with the restriction of certain factors, it creates a unique beauty and powerful order in the design.

Fig. 27: Molla Mills' pattern photo.
Source: Molla Mills' website http://mollamills.com/meetme. (Courtsey of Molla Mills, photos: Saara Salmi )

I sketched out my own patterns on grid paper (Fig. 28 and 29), which offers ideas for prototype design. According to the sketches, I see more possibilities of what can be done: there are various of ways to combine lines, dots and geometric shapes, plus there are so many experiments to achieve with colors. Howaever, most of my color concepts could not be realized due to the limited amounts of plastic bags collected from my friends, neighbors and my own trashcan. For the onward material development and product producing phase, I only applied black, pink, blue and white color of plastic bags in these projects.

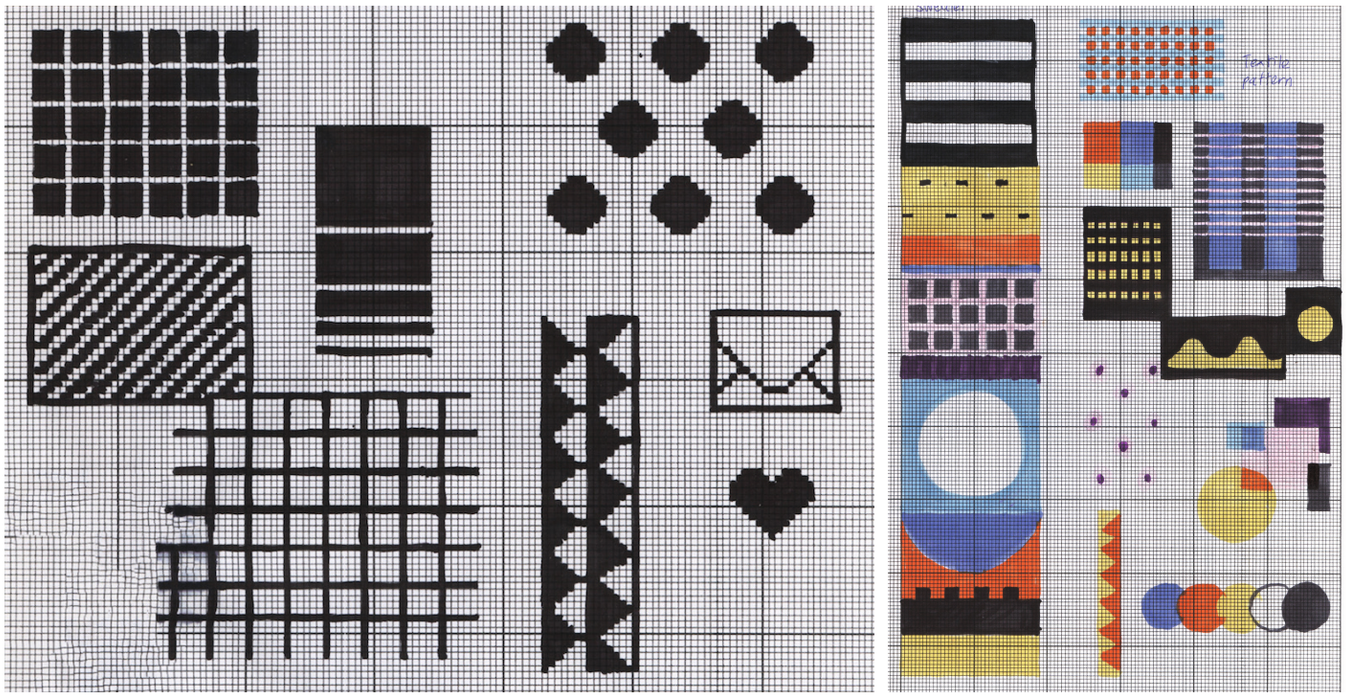

Fig. 28 and 29: visualization of crochet pattern ideas. Image by Wang Jing.

I cut off the top and the end of a plastic bag, folding the rest of the plastic bag four to five times (Fig. 30 and 31), then I made diagonal cuts, the gap of the cuts being around 2 cm (Fig. 32 and 33). After cutting, I unfold the bag to turn it into a long yarn (plarn), then I roll it around a wooden stick (Fig. 34 and 35). This is the process of making plastic yarn; it can be used for crocheting, knitting, weaving and embroidery projects.

Fig. 30-35: The practical process of cutting a plastic bag into yarn
Photos: Tiina Eronen

## Crocheting prototypes

The first craft technique I applied on plastic yarn is the crochet technique; From the sketches I made, there were various patterns and combination to experiment with. I selected some basic patterns and practiced with only the basic single and double crochet stitches. According to the width of the yarn, I decide what size of crochet hook to use. In this case, my yarn width is around two centimeters, which lead me to use small size (two to three millimeters) hooks for crocheting. I crocheted several small prototypes (squares in different color and pattern combination) as Fig. 36 and 37 shown below. The making process was time-consuming because of me being lacking of previous crocheting experience. However, I found out the plastic bag has more traction than cotton or acrylic yarn we usually use. The prototypes turned out to be strong, their hard surface being ideal for creating durable household products such as coasters, baskets or bags. Then I started to apply the results of prototypes into actual product producing phase.

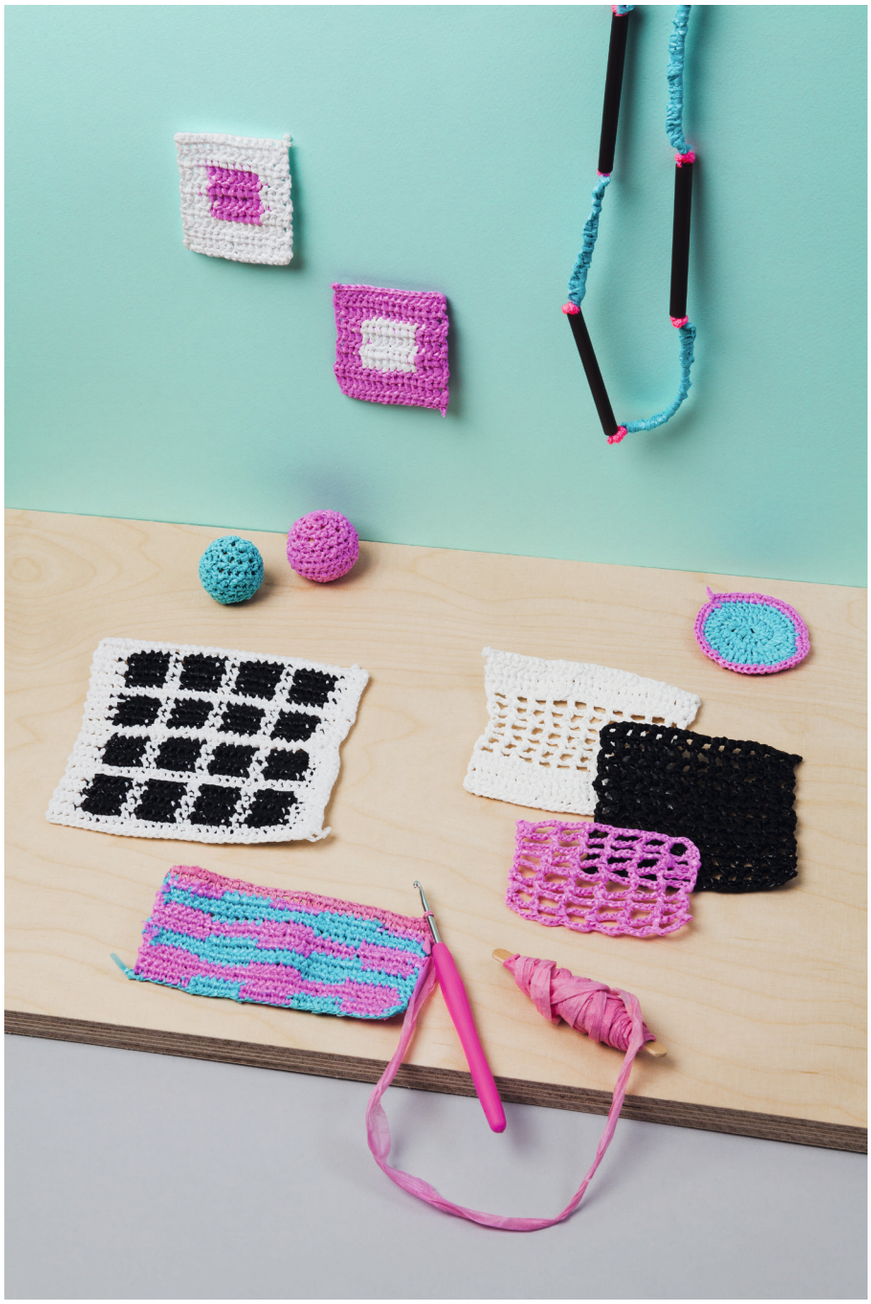

Fig 36: Plastic bag crocheting prototypes.
Photo: Tiina Eronen

Fig 37: Plastic bag crocheting prototypes.
Photo: Wang Jing

## Crochet products: geometry pattern pencil bag

I practiced crocheting techniques such as color increasing and decreasing techniques in order to combine two different colors of yarn (pink and white) together to crochet them into a geometric pattern. After two pieces of the same size are done I sewed them together into a pencil bag (Fig. 38 and 39), adding a zipper on the top and attached a crocheted plastic yarn ball. The pencil bag is not only trendy, but also very sturdy. Even though It is a time-consuming work, the process of creation itself is very enjoyable and rewarding. I was pleasant to hear from people's comments that the product attains such high quality which it is hard to see it actually came from plastic bags.

## Crochet products: Ball-shaped bracelets

Plastic yarn can be also crocheted into a sphere shape by using combinations of chain stitch, single crochet and double crochet techniques (Fig. 40). Starting from six chain stitches, afterwards connecting the last stitch with the first one to form a circle. Then two double crochet on each chain to enlarge the circle into a half sphere. Inserting a bead in the sphere structure and finish off the work with double crochet stitches, by decreasing the stitch gradually. Crochet further using the same method for several balls and connect them together by using a string. The final product turns out to be fashionable, minimalistic and pleasant.

Fig 38 and 39: A pencil bag crocheted from plastic bags
Photos: Wang Jing

Fig. 40: Beads bracelet crocheted from plastic bags
Photo: Wang Jing

Fig 41: Plastic bag crocheting work
Photo: Tiina Eronen

## Fusing technique: plastic bag pouch

The technique for attaching plastic bag sheets together is called fusing, which consists in using cloth iron at its highest heat level to attach seven or eight layers of LDPE-4 plastic bag sheets into a steady, leather-like fabric. The fabric is strong, water-proof and is suitable for all kinds of sewing and quilting projects.

Clean a plastic bag and flatten it (Fig. 42), cutting off its handles and end, fold and cut the rest into several same-sized plastic sheets (Fig. 43). Place seven to eight plastic sheets in between two of parchment paper (Fig. 44). Set the cloth iron to maximum power (Cotton and linen) and place the iron on the top of the parchment paper. Slowly move the iron from the center to edges so there is no air bubble trapped inside (Fig. 45). Do it for four to five times, making sure to apply heat evenly especially on each corner. Turn the sheet over and iron the back side of the sheet four or five times (Fig. 46). Turn the sheet over and repeat previous steps two or three times in order to ensure every piece of sheet is well-attached. Trim the piece (Fig. 47) and place it under a heavy book for a while in order to make the sheet flat.

Fig. 42- 47: How to iron several plastic bags into a fabric.
Photos: Tiina Eronen

After getting several fused plastic sheets, I cut them into the shapes required (Fig. 48) and machine sew them into a zippered pouch (Fig. 49- 53). I paid special attention to the pattern on the plastic bags; according to the size and shape of the pattern, I decided how to cut them. Products I decided on are pouches and purses. There is a “surprise” element in those products since the logo is familiar to people who live in Finland, the source of plastic bags are local supermarkets, pharmacies, department stores, fashion brands and cosmetic products.


Fig. 48- 53: The making process of how to sew plastic fabric into a pouch.
Photos: Wang Jing


Supermarket
POSTITALO
Tavallista parempi ruokakauppa


Fig 54-62: Pouches made from plastic bags.
Photos: Tiina Eronen

## Plastic bottles prototypes:

There are already artists using a heating technique to shape plastic bottles into specific organic shapes. I decided to experiment with this technique with my own design. To start with, I created sketches (Fig. 64) during the concept and visualization phase using different flower and leaf shapes. I cut different colors of plastic bottles according to the shapes I drew and heated them with candlelight (Fig. 63). On account of my previous experience with cutting and trimming plastic bottles, I got various organic shapes in different colors which offered certain possibilities for later stage jewelry making. Then I decide to make actual jewelry pieces using the shapes I got from the experiment.

Fig. 63: Sketches and prototypes, made from plastic bottles. Photo: Wang Jing.

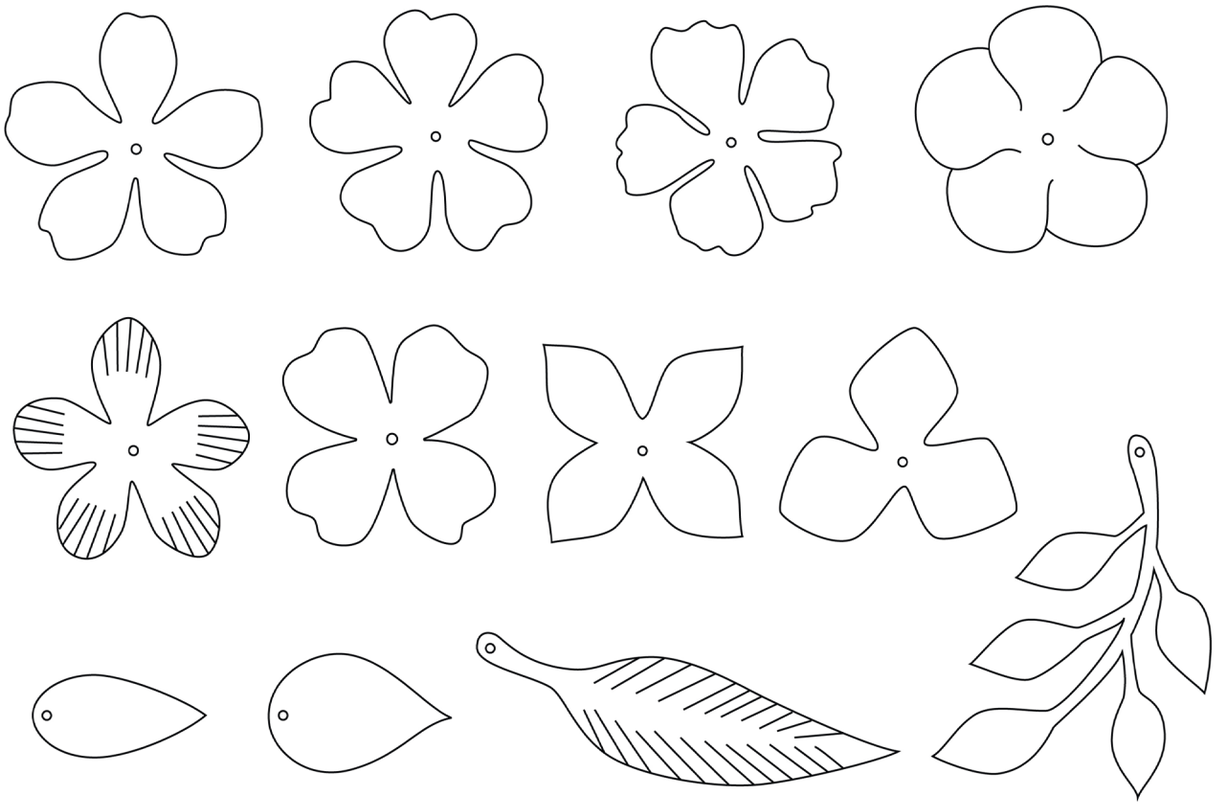

Fig. 64: Brainstorming different shapes. Image by Wang Jing.

## Flower shape jewelry

I cut a plastic bottle into several small pieces (Fig. 65), according to the outlines of flower and leaf shapes I sketched (Fig. 66), then I used a marker to draw the shapes on the surface of several plastic bottle pieces (Fig. 67). Then, cut out the shapes (Fig. 62), trim the edges to make the shape smooth and balanced aesthetically (Fig. 68). Then heat the trimmed pieces on top of candlelight so the shape will curl up (Fig. 69). After heating I got different organic shapes; I colored some of the flowers using nail polish (Fig. 70). Then, assembled them together with jewelry accessories (Fig. 71, 72).


Fig. 65-72: The process of how to upcycle a plastic bottle into jewelry. Photos: Tiina Eronen

I matched randomly various shapes into jewelry such as earrings, rings and brooches. The final product is light, beautiful, strong and durable since the candle heat makes the material structure more compressed. Many people think it would be very pleasant to wear this flower jewelry in the summer (Fig 73- 83).

Fig 73-83: Jewelry made from plastic bottles.
Photos: Tiina Eronen, Wang Jing

## Bottles top necklace

This necklace was invented accidentally during the process of making plastic bottles jewelry (Fig. 84). After cutting many bottles into plastic jewelry as above, there are many bottle tops leftover. I did not want to throw them away since they look so beautiful when gathered together, so I softened the edges by using candle heat, assembled them together into a necklace. The results turn out to be so simple, beautiful and people say it feels “such a luxury” without realizing they actually come from cheap plastic bottles.

Fig. 84: A necklace made from different plastic bottles. Photo: Wang Jing

# Reflections on the process

"When someone reflects on action, they become researchers in their practical context. They are not dependent on the categories of established theory and technique, but constructs a new theory of a unique case" (Schön, 1983, p. 2). Thus, reflection on the process plays an important role when looking back over my own practice, it helps with analyzing what I have created, what happened during the process, what knowledge I gathered after making and eventually effecting my plan for next design session.

### Failure

Failure is an inevitable part of the creative process. When I used candle heat to shape plastic bottle pieces, sometimes the plastic piece shrunk too much due to overheating; sometimes when I sew the plastic fabric together and they were not aligned, I need to open the seam and sew it again. This kind of situations made me frustrated, and sometimes I was unwilling to continue the making process.

Failure usually happens during the prototype phase while exploring new materials and techniques, or during the situation when I was uncertain of what to make, or not fully concentrated on the process. Failure of creation is inevitable, however, it is important to minimize it. Ways to minimize might be: carefully conducted related practices and training, having a clear plan before making, fully concentrating on the making process and choosing the right methods for the making process.

### Searching relevant information on the internet

The internet has become a vibrant place to find pictures of craft projects, by watching videos illustrating techniques, and communicating with craft enthusiasts of all kinds (Torrey, Churchill and McDonald, 2009). However, it is important to search out relevant information by typing corresponding keywords. I typed in words such as "crochet", "upcycle", "plastic upcycling" on the image search engine, Pinterest.com, then the various results came up. Among all these search results, I collected projects relevant to the topic I was looking for, thereafter I collected the key words from their descriptions and searched again for more specific and filtered results; in general this time the search engine provided more optimized results. By getting ideas of what has been done and what can be improved. I collected my favorite product images and built my own Pinterest inspiration board. This online tool also allows me to sort out these images by categories.

According to what project inspiration images I collected, I tried to verify what kind of craft techniques had been applied during these projects. Through searching keywords such as "crocheting", "fusing", "weaving" on YouTube.com, I fished out many correspondent videos demonstrating how the crafts techniques had been conducted. Even if it is a new skill to me, there are lots of video tutorials available for learning new skills directly and immediately, which is quite different from traditional craft learning through apprenticeship.

**Time-consuming craft working**

Even if the process of craft making is meditative and the result is very often rewarding; however, compared to industrial mass-produced products, hand-made objects are challenging to produce because it is time-consuming and requires makers to have certain control of skills, which also demands time for them in development. It is vital to balance the quality of the product with how much time is spent on the production process. Creators can decide whether the piece they are creating is a unique and expensive art piece or a designed product offering a relatively larger scale and cheaper price. I would prefer to create relatively large amounts of household products so they can reach a wider audience; the price ought not be too expensive so that people can afford to use these upcycled products in their daily lives. Thus, the time for makers to spend on making the projects needs to be well-balanced so that the creator gets enough return on the time she spent on it. I consider as creators getting familiar with the material and geting experience, less time will be spent on production as the quality of the product will be improved, and as the efficiency will be enhanced over the time.

**The role of documentation**

Documentation plays a significant role supporting analysis and reflecting on the creative process. I collected data such as sketches, video, notes, diagrams which helped me see what kind of ideas arose in my mind during each phase; it also snared some critical moments I was not conscious of... at the same time it provided me with inspiration might be improved on for future creative adventures.

**Evaluating the results I created by questioning myself:**

When a product has been made, certain standards are attained, therefore, I asked myself such questions to verify the results:

* How does the product look or feel?
* Does the value of basic material increase? Does the lifespan of material expand?
* Did I make the most of the material or did the creative process simply create new waste?
* Did it fit my design standard of upcycling
* Does it fit the result of upcycling design?
* What kind of feedback will get from others?

The answer to such questions could be considered as a summary of the creative process, thus, there will be knowledge generated that is relative to how it might be improved during the onward product development. It also reminds me how to observe closely during every phase of the design methods and learn from my own process.

In summary, upcycling projects need to be carefully planned and conducted; materials should be properly applied to avoid creating new waste if possible; a certain degree of concentration during the process is necessary in case failure occurs. It is vital to learn something new from previous experience, in order to enhance the product quality so the lifespan could be lengthened, thus, certain related skills and experience are still required. Also, to have a good balance between the time spent and the ultimate product price.

# Results

Through practice-led research, the methods I applied for craft-based upcycling design can be defined by six phases (of one iteration): The first phase will be with a personal brainstorming in which ideas are generated without a critical mindset; then the next step is to build an inspirational board for gathering related visual inspiration, followed by a concept and visualization phase for generating ideas; finally with the experimental prototypes phase which can be considered as a journey of material exploration; by using the result of prototypes, the actual product producing will be conducted; in the end the reflection on the process as a summary, which provides possible future improvements and directions to follow.

**(1). Brainstorming**

Results of brainstorming generate data at the early stage of design, even when the structure of the problem has not yet been perceived or transformed. To figure out what to brainstorm, I asked myself the question: What kind of (plastic) material and which (craft) techniques might be used for upcycling? Then the brainstorming might be the process to answer these questions. I listed what kind of plastic trash I generate and the kind of products I make out of them.

**(2). Inspiration board**

Through searching, collecting, sorting and classifying, you can find all kinds of visual inspiration for your project. During my practice-led research, I mainly searched on the internet for resources related to product inspiration (i.e what to make) and technique inspiration (how to do it).

**(3). Concept and visualization**
**Visualization**

enables generating, developing, memorizing concept. Any visual element such as sketches, doodles, infographics, diagrams, words, images can be considered a visualization method. Visualization helps to get abstract ideas down on paper, offering a chance to testify, to experiment and to modify the original idea for further development.

**(4). Experimental Prototype**

The experimental prototype method is a small and quick way to test ideas. Combined with inspirations from “brainstorming”, “inspirational board” and “concept and visualization”, prototypes give the opportunities to see the problems you are attacking more clearly and offer the possible solutions that could be employed into the “product making” phase. If prototypes fail, however, new knowledge will be generated. If a failure occurs, you might need to go back to the “Inspiration board” and “concept and visualization” phase to regenerate concept and test it through again.

**(5). Product making (or producing)**

This phase is the manufacturing of products, combined with the yield experimental prototypes, which turns out to be the application of the prototype results. That is, to come up with a finished product having the potential to be sold in the market.

**(6). Reflection on the process**

Certain questions must be asked in order to analysis the bounty of product creation, for example to ask questions as to whether the expected product quality is enhanced or not; during the process if any other incident occurs, reflection might help to generate new knowledge. New knowledge will be adapted for use in next several iterations.

As the diagram shows below (Fig. 85), one iteration of craft-based upcycling methods include six steps: “brainstorming”, “inspirational board”, “concept and visualization”, “experimental prototypes”, “product making” and “reflection on the process”. There may be more than one iteration depending on the actual situation. As the product develops, steps such as “brainstorming” and “inspirational board” steps might be skipped.

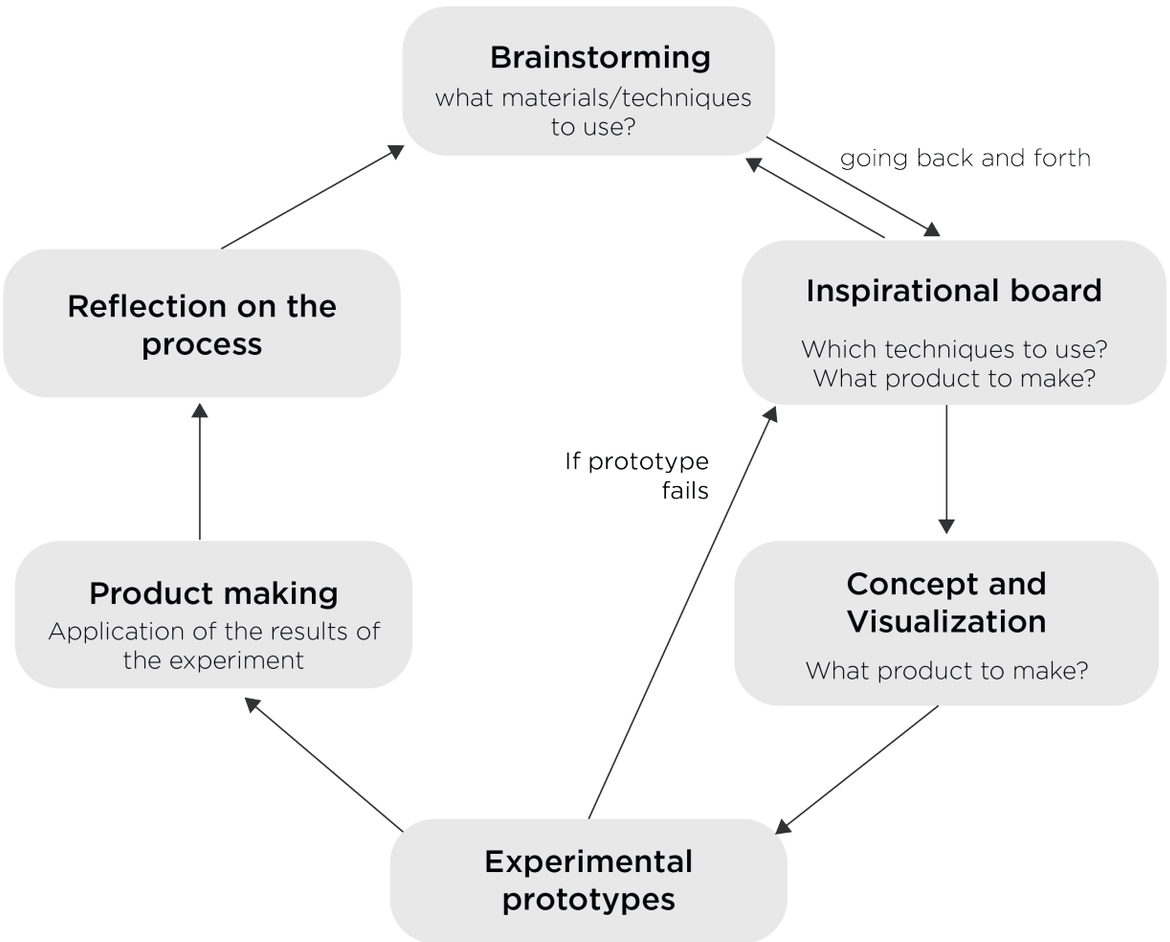


Fig 85: One iteration of phases for craft-based upcycling design method??. Image by Wang Jing.

# Discussion

Jones (1980, p. 21) suggested "the main purpose of 'the design process' is collective learning, the deliberate seeking of new ways of living, so we must expect to make changes in our processes and procedures (for this learning often takes the form of sudden insights) ... One should expect confusion, loss of confidence, and procedural chaos to arise out of one's original strategy and be ready to jump into what feels better." Thus, the phases in the design methods that I discovered above are suitable for exploring unfamiliar wasted materials and learning new craft techniques.

Lawson (1980, p. 108) described a five-stage process (Fig. 86) consisting of first insight, preparation, incubation, illumination and verification which form the model of creative thinking. "First insight involves the recognition that a problem exists and a commitment is made to solve it. The formulation of the problem may often be a critical phase in design situations; preparation involves much conscious effort to develop an idea to solve the problem. There may be much coming and going between these first two phases as the problem itself is reformulated or even completely redefined; Then follows a period of incubation which involves no apparent effort, but which is often terminated by the sudden arrival of an idea (illumination). Once the idea has emerged, the final period of conscious verification in which the outlined idea is tested and developed."

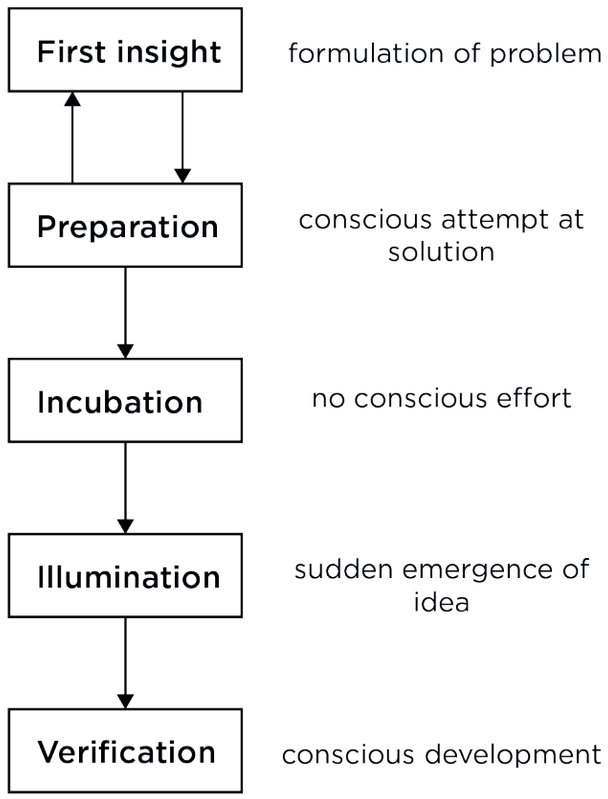


Fig. 86: The five-stage model of the creative process
Source: Lawson, B. (1980, p. 108)

Compared to Lawson's model, my methods are a complex combination of the five stage model. As Fig. 87 shows, Brainstorming is the correspondent stage for first Insight to generate and answer the questions; Inspirational board is related to stages first Insight and preparation; Concept and visualization consists of preparation and incubation which is aiming to answer the question; Experimental prototypes is the combination of preparation, incubation and illumination, however there might be a failure happening during this phase and the designer might have to jump back to the Inspirational board phase in order to redo the concept and visualization and Experimental Prototypes stage; Then the following phase, Product making which is related to the result of Experimental prototypes; I don't consider this exactly is the illumination Lawson described, so instead I give the name Application to it. The last step Reflection on the process is Lawson's verification step. Even though there are lots of similarities, as the diagram shows, my methods are circular processes and might be adapted into one or several iterations depending on the actual situation. Lawson's methods could be described as linear processes.

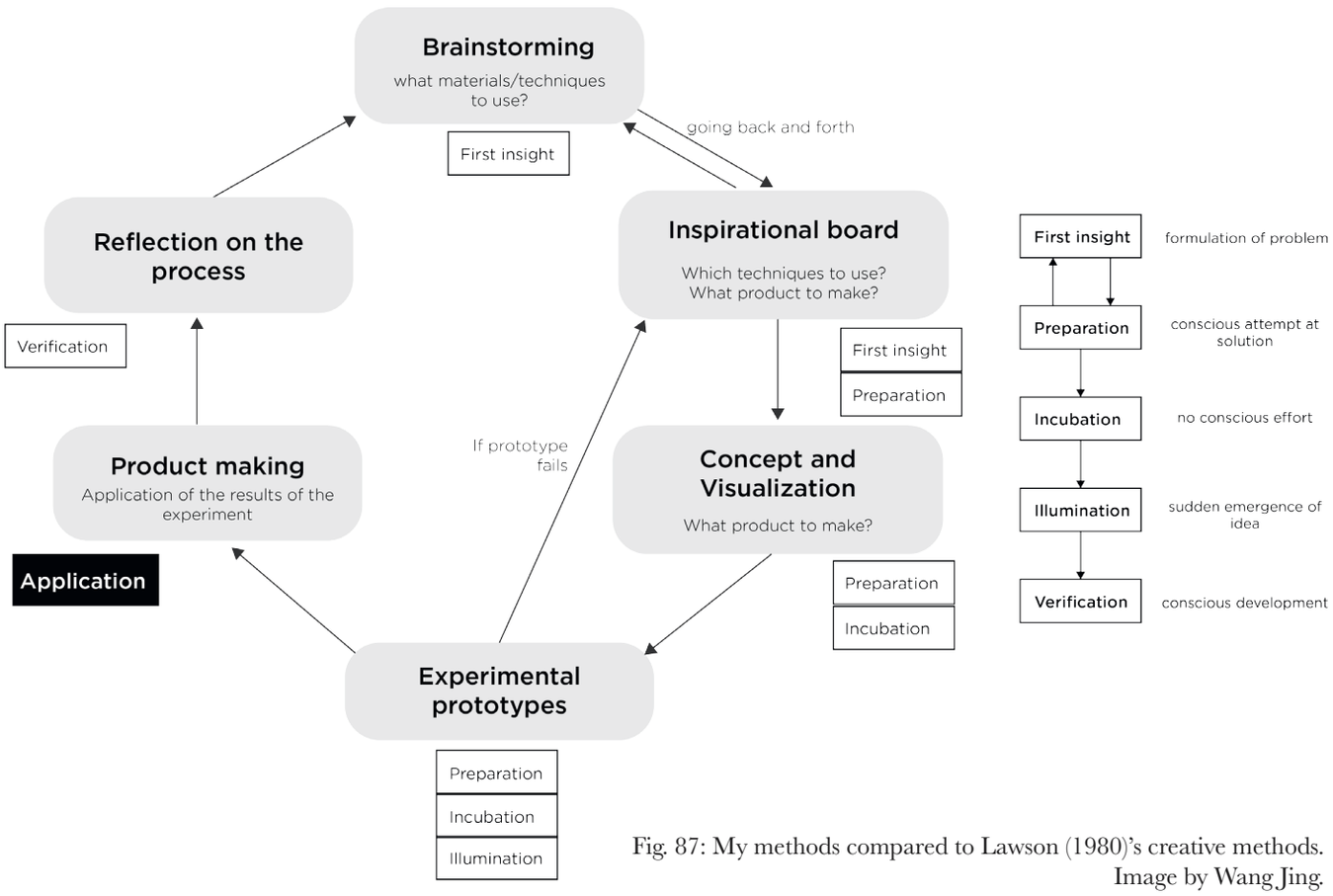


Fig. 87: My methods compared to Lawson (1980)'s creative methods. Image by Wang Jing.

It is also important to note what Jones (1980, p. 19) suggests: “a design method is any action one may take while designing […] But, whatever one chooses to do, there is one principle involved: choose whatever method will tell you what you do not know, but need to know, then to proceed”. The above-mentioned methods are suitable for a specific design situation and to to explore it with an unusual design material – plastic waste serves in our daily life unfortunately. However, designers are recommended to plan beforehand what kind of methods to use according to what kind of situation they find themselves in. For example, if a designer is dealing with textile waste, then there might be no need for brainstorming for what kind of material to use as plastic waste. Also, less time might be spent during the experimental prototype phase because the textile waste quality is more recognizable and easier to manage than plastic waste. When looking back over my practice-led research, it did provide with me an intimate personal experience of the waste material and possibilities of developing unique knowledge. Compared to other research methods I used, such as literature review and interviews which were focused on learning from other’s knowledge and experience, practice-led research has set me into a special position as both researcher and practitioner. The knowledge, generated from this experience, offered me a deeper dimension: it is recommended to all designers and researchers who want to unveil design its deeper and wider aspects. As a result, there will be specific and personal critical incidents discovered during the making and reflection process.

The theory part of upcycling design could be deepened further, especially by giving a wider choice of possible methods for upcycling design; both through craft making and design for mass-production. Further research on a larger scale of waste material upcycling will also be needed.

# Conclusion

This practice-led exploratory study includes three parts: literature review, interviews and practice-led research on the possible methods for craft-based upcycling design. The research aims to answer the question: what methods can be developed for craft-based upcycling design?

My literature review described the current knowledge and understanding of upcycling design. Through reviewing related books, articles and theses, the following questions were answered: What is upcycling design anyway? (definition of upcycling), what are the benefits of upcycling? What are the results of upcycling? What kind of limits, challenges and support upcycling have?

Interviews with upcycling designers and educators in Finland demonstrated current designers' insights, inspirations, techniques and materials and what kind of products they make. According to the interviews, certain factors leading to successfully upcycling design were identified as: (1). Passion for design or craft making; (2). Experience, related background and training; (3). Good tools, machinery and accessories; (4). Think outside of the box.

Inspired by the literature review and the interviews, I conducted my own practice-led design and making process and developed methods for craft-based upcycling as shown in this thesis. I detected six phases that were repeated in these methods : (1). Brainstorming on materials and what products to create; (2). Building an inspirational board for what techniques to select and what products to create; (3). Visualization of concepts; (4). Experimental prototypes creation; (5). Product producing; (6). Reflection on the process. These phases are considered as one iteration, there can be several iterations depending on the situation.

This experience has brought me to work closely with the material itself and be mindful throughout the whole design process through documentation. The results, however, cannot be effective due to limitations of time, inexperience with various craft skills or mastery of different new materials. Future study should focus on a broader understanding of upcycling design, deeper exploration of materials and crafts techniques, and a comprehensive researching of upcycling situations in different countries. Above all, to develop feasible business models combining creativity, ecology and economy, to render the upcycling business more approachable and suitable to the local community. As the Prime minister of Bhutan has said (Bhutan, 2012, The Hoffing Post);

*"Economic growth is important, but it must be balanced with other important aspects of life, including culture, spirituality, heritage and also the environment. So there's always been a strong emphasis on the environment and sustainable development."*

*–Tshering Tobgay*

Possible future research options
To build contacts with enterprises (for example IKEA, H&M), helping them to sort out the waste they generate, whether there are any possibilities for re-employment, recycling or upcycling, or even to figure out a plan for manufacturing on a large scale, or to make the utmost use of their material and respect their budget for discarding or burning off the material they do not need. Then, by arranging to have physically-challenged/unemployed/poor people to

take on upcycle projects, or designing a specific training program to direct them how to upcycle, how to sell their upcycled products online (and offline), offering them corresponding marketing skills, or even helping them arrange the sell of the products elsewhere on a large scale, in order to give them opportunities to earn higher income and enhance their quality of life.

Considering Chinese and Finnish upcycling situations, it is vital to locate various design and business environments, by enhancing people's awareness of environmental standards, and educate them to buy more upcycled products rather than cheap consumer goods; to figure out design solutions to help designers to upscale their upcycling business, and above all, to help them in the marketing of their upcycled works and further support such as funding and policy.

How to build bridges between Finland and China by communicating Finnish Recycling Center ideas (Fig. 88). Until now China does not have any proper infrastructure for waste management, there is no trash sorting system and the recycling rate is abysmally low, millions of tonnes of trash being accumulated every day both in rural and urban areas. The main way to deal with trash is still to incinerate it and put it in the landfill. People throw away many of their things because they do not have use for them. It is very necessary to have a Recycling Center for people to donate their unwanted goods for re-employment, recycling and upcycling.


Fig. 88: An example of a future research project: exporting Finnish Reuse Center ideas to China. Image by Wang Jing.

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